State of California

Memorandum

4-7

The Resources Agency

To : Bob Middleton, Chief
Compliance Monitoring Unit
Division of Operations and Maintenance

Wayne Gentry, Chief
Data and Flood Control Planning Branch
Central District

From : Department of Water Resources

Date : FEB 20 1985

File No.:

Subject: Summary of Water Quality Monitoring During 1984 Old River Closure

The combined effects of seasonal low flows and Federal and State water project operations sometimes create flow reversals and low dissolved oxygen problems in the San Joaquin River system. To minimize the detrimental effects of these adverse conditions near Stockton, the Department installs a rock barrier at the head of Old River upon request by the Department of Fish and Game. This usually occurs when flows at Vernalis fall below 500 cubic feet per second. This control structure effectively forces a greater portion of the San Joaquin River flow downstream past Stockton, instead of allowing it to be diverted down Old River to the export pumps. The greater flow flushes out the "pollution block" that forms in the deep ship channel and creates a net downstream flow for migrating salmon. Placement of the closure and associated water quality monitoring are part of an effort to restore depleted fall salmon runs in this area.

In 1984, the closure was completed on September 8 and removed on October 19. Attached is a summary of water quality monitoring on September 4 and October 5 to determine effectiveness of the control structure.

Attachment

cc: Jim Snow

SURNAME		

SUMMARY OF
WATER QUALITY MONITORING DURING 1984 OLD RIVER CLOSURE

In 1984, guidelines for installation of the rock barrier across Old River at its juncture with the San Joaquin River were taken from the pending Two-Agency Fish Agreement between the Department of Water Resources (DWR) and the Department of Fish and Game (DFG). The criterion specified in that agreement is to provide a minimum net downstream flow of 500 cfs in the San Joaquin River past Stockton. According to the Sacramento Valley Four Basin Index defined in Water Right Decision 1485, water year 1984 was classified as wet, with modification for subnormal snowmelt.

Responsibility for implementing the water quality monitoring in 1984 was assigned to the D-1485 Monitoring and Analysis Section, Central District. Program management remained with the Division of Operation and Maintenance. Water quality data gathered by DWR were periodically reviewed by DFG to determine if further measures would be necessary to improve conditions for migrating salmon.

The closure was started on September 5 and completed on September 8. DFG had requested that the barrier remain in place until November 30 so that late migrants could benefit from the increased net flows. However, the closure had to be removed on October 19, when the right levee embankment adjacent to the barrier began to erode, causing a 90- by 30-foot hole. DFG concurred in removal of the closure at that time because unseasonably low temperatures and excessive rains, coupled with higher outflows, had improved water quality conditions in the Stockton Deep Water Ship Channel.

The area monitored in 1984 was from Prisoner's Point, on the San Joaquin River, to the Deep Water Ship Channel turning basin near Stockton (see Figure 1). To increase sampling accuracy and efficiency in 1984, the D-1485 Monitoring Section used a land-based continuous monitoring station on Rough and Ready Island, which has telemetry capabilities. Real-time dissolved oxygen (DO) readings were made available for use by DWR and DFG upon interrogation from Sacramento. The land-based station allowed DWR to schedule special DO runs from a remote location based on actual water quality conditions, as opposed to random runs with the research vessel San Carlos, to ensure criteria were being met. This resulted in an estimated savings of $4,500.

On September 4 and October 5, the San Carlos was used to collect samples at depths of 1 meter below the water surface and 1 meter off the channel bottom at 12 sites during the morning ebb slack tide. Discrete measurements included DO, electrical conductivity (EC), air and water temperature, and depth of channel. Continuous parameter profiles were charted for DO, turbidity, in-vivo chlorophyll, pH, EC, and water temperature. Results are shown in Table 1.

The September run provided a base condition to compare water quality changes resulting from installation of the barrier. At that time a classic DO sag was measured in the ship channel between Light 12 and Light 34 (see Figure 2). The sag actually extended into the turning basin, but was interrupted by higher DO water entering the channel from the upper San Joaquin at Light 48. This caused DO values to increase from Light 34 to Light 48, with a noticeable peak at Light 48. The elevated value in the turning basin was the result of a dense,

highly visible algal bloom (described as a "green soup"). This enhanced algal activity results in highly oxygenated water due to photosynthetic action. Typically, the bottom DO is depressed, with a sharp saturation interface at the euphotic zone boundary (extent of available light for photosynthesis). The entire water column becomes deficient in DO during non-daylight hours.

Dissoved oxygen levels of 5.0 mg/L or more are believed to be necessary to encourage fish to migrate through the ship channel into the upper San Joaquin River to spawn. The post-closure survey on October 5 showed that DO levels were all above 6.9 mg/L, except for the bottom measurement in the turning basin (see Figure 3). This lower value of 6.4 was probably due to organic material from the earlier algal bloom settling to the bottom, creating a biological oxygen demand.

The pre- and post-closure runs both reflect the reverse salinity gradient usually formed by the high volume of agricultural waste water being discharged into the system. The higher EC water was transported down the San Joaquin River and, after entering the ship channel, mixed with lower EC water originating downstream.

DWR and DFG considered a third run to measure any adverse consequences at the time the barrier "washed out". However, based on data from the Rough and Ready Island station, it was deemed unnecessary. Average hourly DO readings from that land-based station from the time of closure through November never dropped below 5.0 ppm.

In addition to the water quality monitoring, water flow was measured down the San Joaquin River and Old River after the rock barrier was installed. Although the quantity of flow involved is important, the main objective is to maintain a net downstream flow pattern, which provides "homing" water for migrating salmon. After the barrier was installed, flows down both the San Joaquin River and Old River were positive (downstream): 2,237 cfs down the San Joaquin and 803 cfs down Old River.

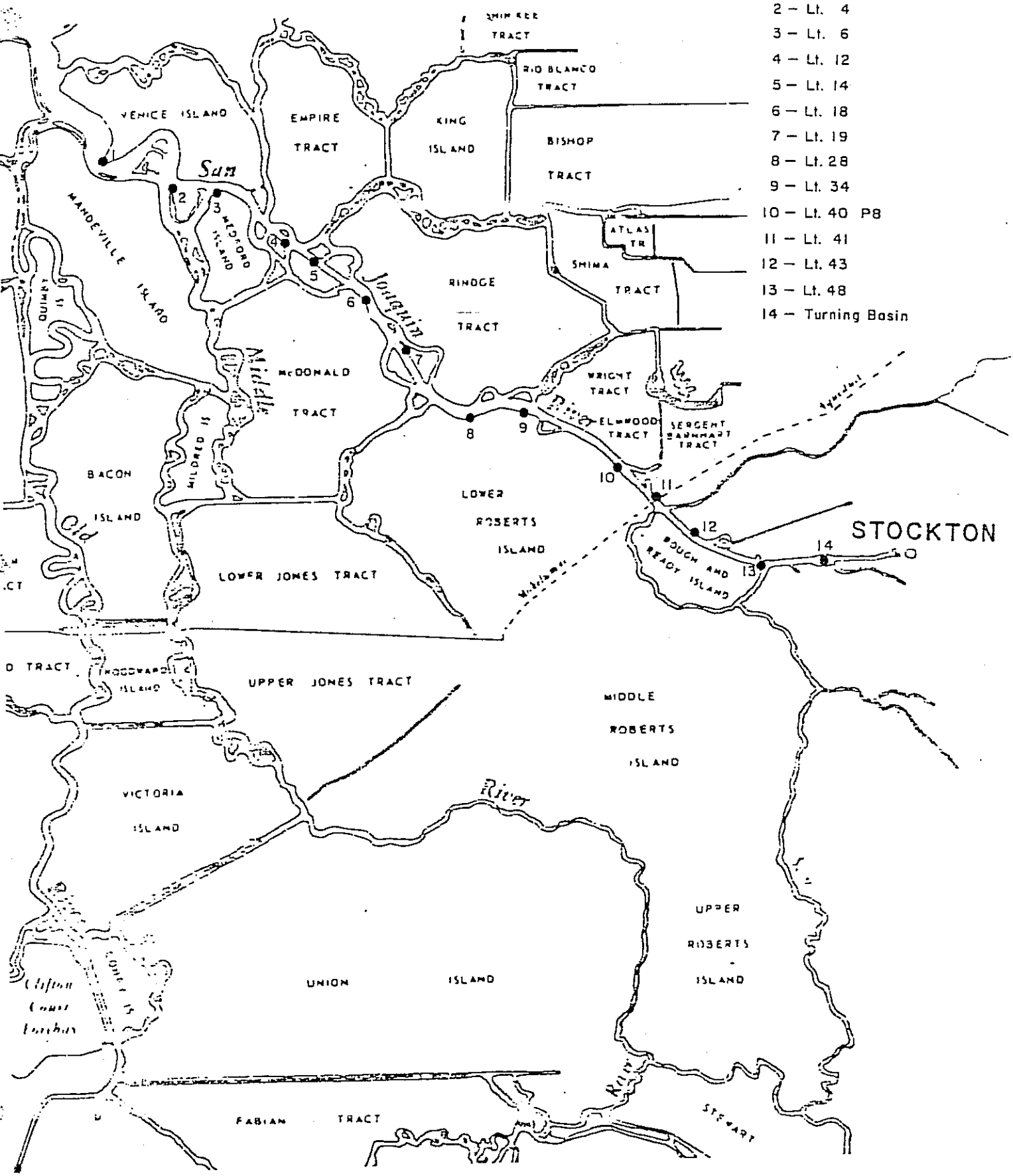
Table 1

STOCKTON DISSOLVED OXYGEN STUDY FIELD DATA — 1984

Station	09/04/84 DO (mg/L)	EC (uS/cm)	Water (°C)	Air (°C)	10/05/84 DO (mg/L)	EC (uS/cm)	Water (°C)	Air (°C)
Light 6	7.7	214	23	24	7.6	306	20	17
	7.8	205	23		7.7	302	20	
Light 12	7.3	239	24	24	6.9	383	20	19
	7.3	232	23		7.2	370	20	
Light 14	6.7	366	24	25	6.9	424	20	20
	6.7	345	24		6.9	423	20	
Light 18	6.1	584	24	26	7.0	415	20	22
	6.2	410	24		6.9	417	20	
Light 19	5.8	498	24	26	7.1	411	20	22
	5.6	512	24		7.0	416	20	
Light 28	5.4	533	25	28	7.3	408	20	22
	5.2	546	24		7.2	409	20	
Light 34	5.3	539	24	28	7.1	413	20	24
	5.0	456	24		7.4	406	20	
P8	6.2	548	25	29	8.3	400	21	23
	5.3	550	24		7.6	407	20	
Light 41	6.4	522	25	32	7.9	400	20	23
	5.7	541	24		7.8	419	20	
Light 43	6.8	548	24	34	8.1	417	20	23
	5.4	541	24		7.8	411	20	
Light 48	6.6	498	24	35	7.9	392	20	24
	6.1	450	24		7.8	387	20	
Turning Basin	9.4	600	25	35	7.8	480	21	25
	4.6	528	24		6.4	427	20	

First value = 1 meter below water surface.
Second value = 1 meter above channel bottom.

FIGURE 1


1 – Lt. 57 Prisoners Point
2 – Lt. 4
3 – Lt. 6
4 – Lt. 12
5 – Lt. 14
6 – Lt. 18
7 – Lt. 19
8 – Lt. 28
9 – Lt. 34
10 – Lt. 40 P8
11 – Lt. 41
12 – Lt. 43
13 – Lt. 48
14 – Turning Basin
STOCKTON
VENICE ISLAND
EMPIRE TRACT
KING ISLAND
RIO BLANCO TRACT
BISHOP TRACT
MANDEVILLE ISLAND
MEDFORD ISLAND
ATLAS TR
SHIMA TRACT
RINDGE TRACT
McDONALD TRACT
WRIGHT TRACT
ELMWOOD TRACT
SERGENT BARNHART TRACT
BACON ISLAND
LOWER ROBERTS ISLAND
LOWER JONES TRACT
BOUGH AND BEACH ISLAND
UPPER JONES TRACT
MIDDLE ROBERTS ISLAND
VICTORIA ISLAND
UNION ISLAND
UPPER ROBERTS ISLAND
FABIAN TRACT
STEWART
San Joaquin River
Old River
Middle River
Mokelumne

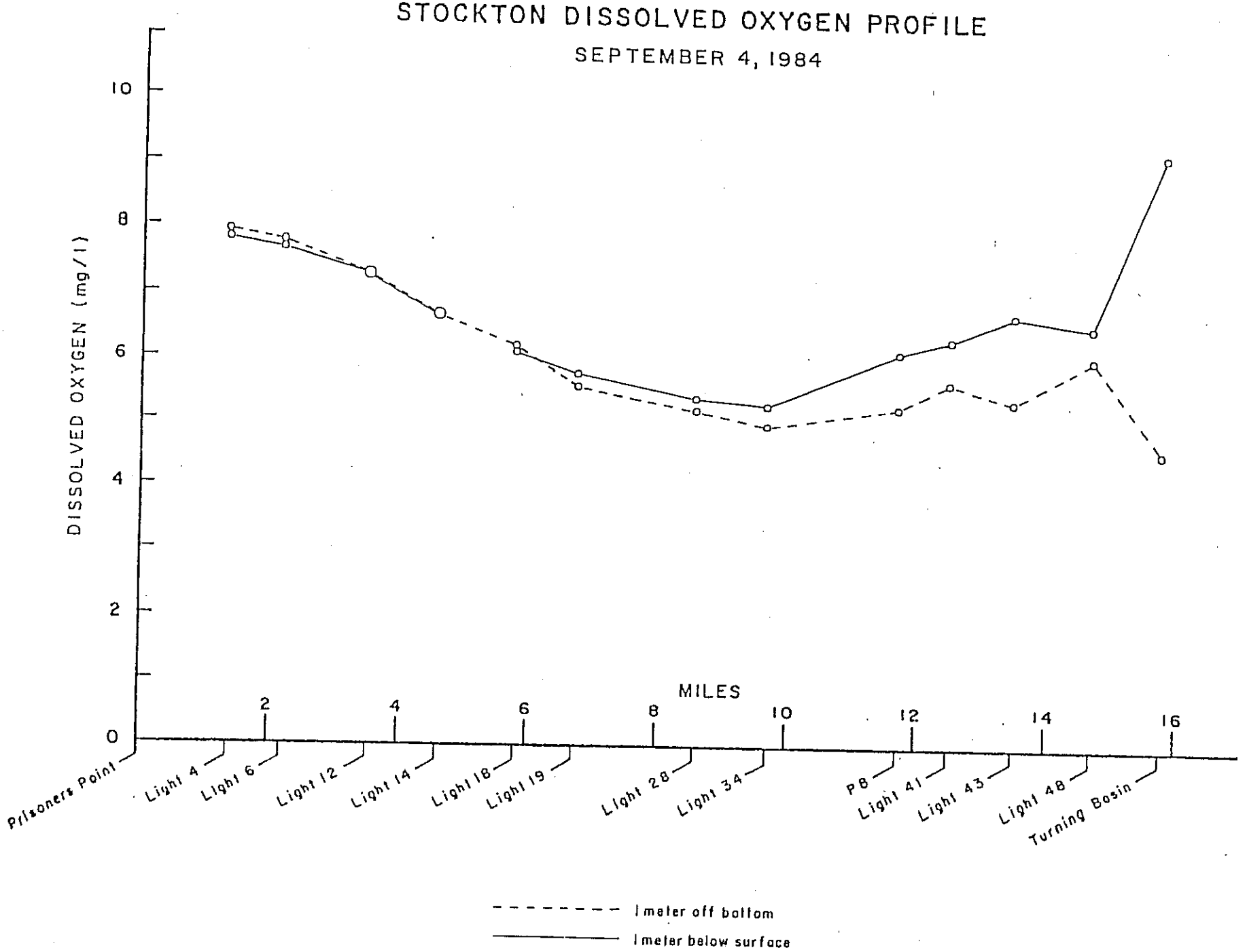
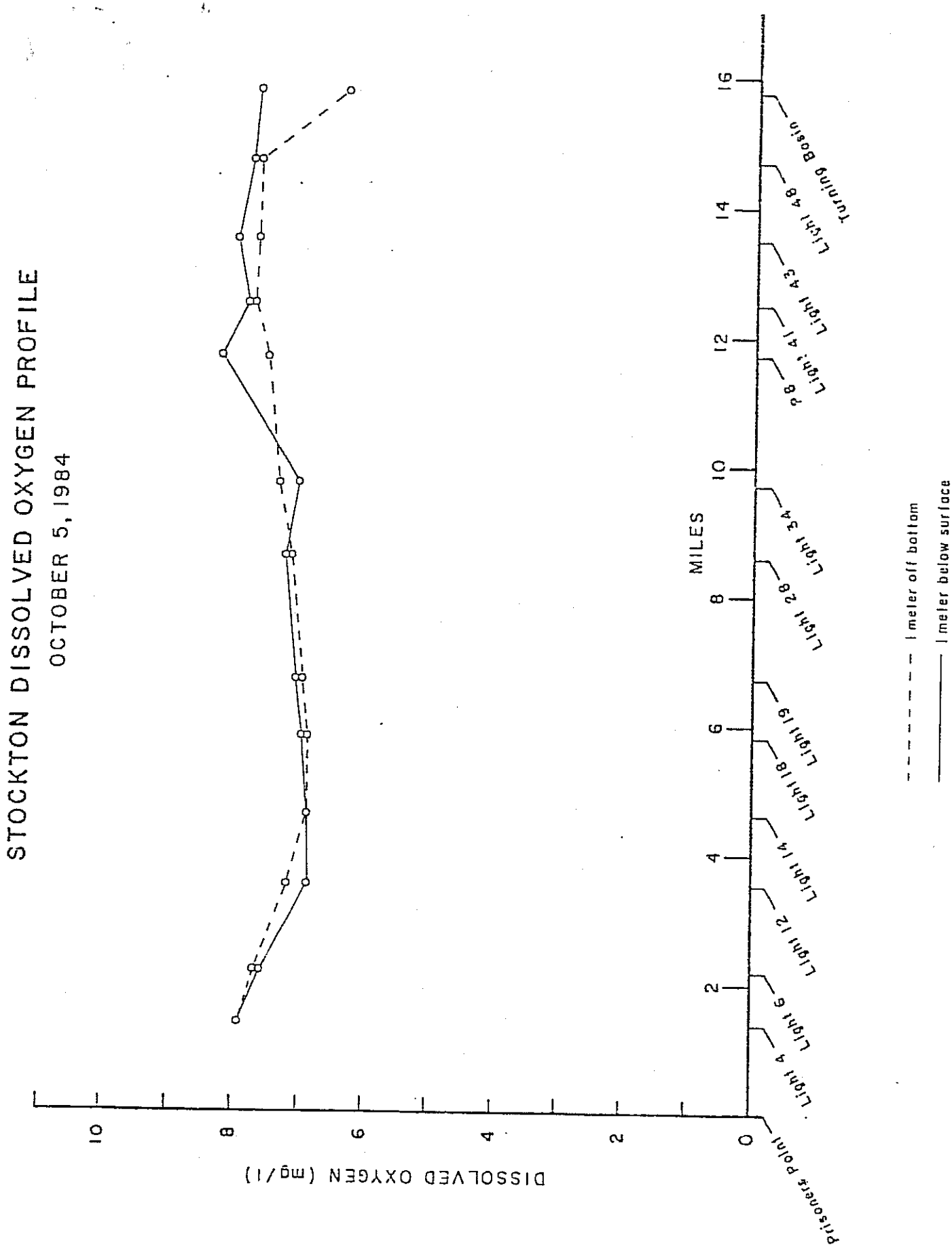

STOCKTON DISSOLVED OXYGEN PROFILE
SEPTEMBER 4, 1984
DISSOLVED OXYGEN (mg/l)
10
8
6
4
2
0
MILES
2
4
6
8
10
12
14
16
Prisoners Point
Light 4
Light 6
Light 12
Light 14
Light 18
Light 19
Light 28
Light 34
P8
Light 41
Light 43
Light 48
Turning Basin
1 meter off bottom
1 meter below surface

FIGURE 2

FIGURE 3


STOCKTON DISSOLVED OXYGEN PROFILE
OCTOBER 5, 1984
DISSOLVED OXYGEN (mg/l)
0
2
4
6
8
10
MILES
2
4
6
8
10
12
14
16
Prisoners point
Light 4
Light 6
Light 12
Light 14
Light 18
Light 19
Light 28
Light 34
Light 41
Light 43
Light 48
Turning Basin
1 meter off bottom
1 meter below surface